



Standard Test Method for Estimation of Deleterious Particles in Lubricating Grease¹

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1. Scope

- 1.1 This test method covers a procedure for the detection and estimation of deleterious particles in lubricating grease.
- 1.2 This test method is applicable to all lubricating greases. It can also be used to test other semi-solid or viscous materials. Grease fillers, such as graphite and molybdenum disulfide, can be tested for abrasive contaminants by first mixing them into petrolatum or grease known to be free of deleterious particles.
- 1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Within the text, the SI units are shown in brackets.
- 1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

- 2.1 *ASTM Standards:*²
 - D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
 - D785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
 - D4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants

3. Terminology

- 3.1 *Definitions*—See Terminology D4175.
- 3.2 *Definitions:*
 - 3.2.1 *lubricant, n*—any material interposed between two surfaces that reduces the friction or wear between them.
 - 3.2.2 *lubricating grease, n*—a semi-fluid to solid product of a dispersion of a thickener in a liquid lubricant.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products—Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.G0.01 on Chemical and General Laboratory Tests.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.2.1 Discussion—

The dispersion of the thickener forms a two-phase system and immobilizes the liquid lubricant by surface tension and other physical forces. Other ingredients are commonly included to impart special properties.

3.2.3 *thickener, n*—in lubricating grease, a substance composed of finely-divided particles dispersed in a liquid lubricant to form the product's structure.

3.2.3.1 Discussion—

The solid thickener can be fibers (such as various metallic soaps) or plates or spheres (such as certain non-soap thickeners), which

are insoluble or, at the most, only very slightly soluble in the liquid lubricant. The general requirements are that the solid particles be extremely small, uniformly dispersed, and capable of forming a relatively stable, gel-like structure with the liquid lubricant.

3.3 Definitions of Terms Specific to This Standard:

3.3.1 *deleterious particles, n*—in lubricating grease, minute bits of solid material present as a contaminant and abrasive to acrylic plastic.

4. Summary of Test Method

4.1 A small portion of the lubricating grease sample is placed between two clean, highly polished acrylic-plastic plates held rigidly and parallel in metal holders. A pressure of 200 psi [1.38 MPa] is applied, and one plate is rotated 30° relative to the other. Particles harder than the plastic and exceeding in size the distance between the plates will imbed in the plates and cause characteristic, arc-shaped scratches in the plates.

4.2 The relative number of such solid particles can be estimated by counting the total number of arc-shaped scratches on the two plates.

5. Significance and Use

5.1 The significance of the number of scratches as far as correlation with field performance is concerned has not been established. A particle which is abrasive to plastic will not necessarily be abrasive to steel or other bearing materials. Some correlation was obtained in that the contaminant used in Sample 3 (see 10.1.1) had a greater wear rate in a laboratory ball bearing abrasive wear test than the contaminant in Sample 2.

NOTE 1—The number of scratches obtained cannot be used to draw fine differences between greases, but rather, to group them into two or three general classes. One such possible division could be:

- 1 less than 10 scratches
- 2 10 to 40 scratches
- 3 more than 40 scratches

5.2 An advantage of this test method is that each test takes only a few minutes to run.

5.3 This test method is used for quality control and specification purpose.

6. Apparatus

6.1 The test apparatus is shown in Figs. 1 and 2. As illustrated in Fig. 2, the plastic test plates (commercial acrylic plastic, produced in uniform, highly polished sheets),^{3,4} 1, are rigidly held in a parallel position in square recesses in parts 2 and 7. The holder, 7, is part of the cap assembly, 7 to 11, which can be removed as a unit from the body, 3, by removing four cap screws. The lower plate holder, 2, can slide along the axis of the main housing, but it is restricted from turning by keys spaced 180° apart. Pressure is applied to the plastic plates, 13, through the holder, 2, by means of the coil spring, 4, spring follower plate, 5, and loading screw, 6. The large loading screw also serves as a base for the apparatus. The indicator pin, 12, on the spring follower plate, 5, shows the linear amount of spring compression, which in turn, is a measure of the pressure applied to the two plastic plates. The upper holder, 7, is kept from rotating by the threaded pin, 9, which projects through a milled slot in cap, 8, and ends with a locking wing nut, 14. To rotate the upper plate and holder, the wing nut is loosened, and the handle, 11, is turned. A leather washer, 10, between holder, 7, and cap, 8, is used to facilitate turning.

NOTE 2—Although 6.1 describes an apparatus of specific design, any other device that provides the essential operating conditions can be used. Such device is permitted if it can hold the two plastic test plates parallel to each other; apply and measure a minimum pressure of 200 psi [1.38 MPa] on the plastic plates; and provide for 30° relative rotation of the two plates.

6.2 *Plastic Test Plates*⁴⁻⁵—acrylic plastic test plates (two per test), 1 ± 0.050 in. square by 1/8 ± 0.025 in. [25.4 ± 1.3 mm square by 3.2 ± 0.64 mm] uniformly thick, having a Rockwell M hardness of 94 ± 10 (Test Method D785), and having highly polished surfaces protected on both sides with protective paper.

NOTE 3—Whether dimensioned in inches or millimetres, the plastic test plates should be fabricated to match the square recesses in holders 2 and 7.

7. Reagents and Materials

7.1 Stoddard solvent conforming to Specification D235. (**Warning**—Flammable. Vapor harmful.)

NOTE 4—Other naphthas or pure paraffinic hydrocarbons, such as *n*-heptane, can be substituted providing they are suitable volatile and do not soften or otherwise attack acrylic plastic.

³ The sole source of supply of sized test plates known to the committee at this time is Koehler Instrument Company, Inc., 1595 Sycamore Ave., Bohemia, NY 11716.

⁴ If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

⁵ The apparatus shown in Figs. 1 and 2 is available from Falex Corp., 1020 Airpark Dr., Sugar Grove, IL 60554-9585, and from Koehler Instrument Company, Inc., 1595 Sycamore Ave., Bohemia, New York 11716.